

Enhancing Student Learning Outcomes Through Quizizz-Supported Culturally Responsive Teaching in Problem-Based Learning

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ABSTRACT

Many students face academic engagement and achievement challenges due to the lack of culturally relevant instructional materials. This study examines the effectiveness of integrating Culturally Responsive Teaching (CRT) with Problem-Based Learning (PBL), supported by Quizizz, in improving student learning outcomes in Science and Social Studies (IPAS). Conducted as a Classroom Action Research (CAR) study using Stringer's model, the research involved two cycles with 28 fourth-grade students at SDN Empang 2 Bogor. Data collection methods included classroom observations, formative assessments, and student performance analysis. The findings indicate a significant improvement in student learning outcomes, with average scores increasing from 67 in Cycle 1 to 80 in Cycle 2. The proportion of students meeting the minimum competency threshold rose from 46% to 75%. A paired t-test confirmed that these improvements were statistically significant ($p < 0.05$, Cohen's $d = 1.18$), indicating a strong effect of the CRT-PBL model. Integrating culturally relevant content, problem-solving strategies, and gamified assessment through Quizizz enhanced student engagement, motivation, and conceptual understanding. This study highlights the potential of CRT-PBL combined with educational technology to foster active learning in diverse classrooms. Future research should explore its long-term impact and applicability across different subjects and educational settings.

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1. INTRODUCTION

Despite efforts to implement student-centred learning, many students struggle with low engagement and poor academic outcomes due to a lack of cultural relevance in instructional materials. Research indicates that motivation and conceptual understanding decrease significantly when learning materials fail to connect with students' cultural backgrounds [1], [2]. Various pedagogical approaches have been explored in response to this

issue, including the Culturally Responsive Teaching (CRT) approach, which integrates students' cultural identities into learning, making instruction more meaningful and engaging. Meanwhile, Problem-Based Learning (PBL) is widely recognized for fostering critical thinking and problem-solving skills through real-world challenges [3], [4]. However, implementing PBL in diverse classrooms often lacks cultural sensitivity, which may limit its effectiveness in engaging students from different backgrounds. Thus, an instructional model combining CRT and PBL's strengths is needed to optimize learning outcomes. This study explores the integration of CRT with PBL, supplemented by Quizizz, to create a more interactive and culturally relevant learning experience that enhances student participation and academic achievement.

This classroom action research was conducted at SDN Empang 2 Bogor, specifically in class IVA for Science and Social Studies (IPAS), focusing on Indonesian Cultural Wealth. The study was initiated based on direct observations by the class teacher regarding student characteristics and cognitive and non-cognitive diagnostic tests. The primary issue identified was low student learning outcomes, with many failing to achieve scores above the KKTP. Several contributing factors included poor conceptual understanding, low student motivation, limited engagement in the learning process, and a weak connection between instructional materials and students' real-life experiences. This highlights the importance of designing learning activities that are more contextual, engaging, and culturally inclusive.

Observation results show that students exhibit greater enthusiasm and active participation when engaged in interactive, culturally relevant, and gamified learning experiences. They prefer methods that integrate local cultural elements and materials linked to their daily experiences and interests. Additionally, gamification strategies, such as interactive quizzes and group-based challenges, have significantly boosted their motivation and involvement. Addressing low motivation and poor learning outcomes is crucial, as these issues hinder students' ability to grasp concepts effectively and apply their knowledge in real-world situations. Therefore, a pedagogical intervention that combines cultural responsiveness, active learning, and technology-driven assessments is necessary to enhance student engagement and academic success.

One approach that has gained attention for bridging this gap is Culturally Responsive Teaching (CRT). CRT emphasizes the integration of students' cultural backgrounds and experiences into learning [5], [6]. Educators implementing CRT strive to incorporate cultural diversity into instructional design, ensuring lessons are relevant and engaging [7]. Research has shown that CRT enhances student engagement and academic achievement through increased cultural relevance and active participation [8]. However, the effectiveness of CRT can be further enhanced when combined with instructional models that promote inquiry-based learning and problem-solving skills.

In alignment with student-centred and contextual learning principles, Problem-Based Learning (PBL) is recognized as an effective model for developing problem-solving abilities and conceptual understanding [9], [10], [11]. PBL encourages students to analyze real-world problems, collect relevant information, and formulate creative solutions in collaborative settings [12], [13], [14]. Empirical studies have demonstrated that PBL fosters higher-order thinking skills, student engagement, and academic performance across various subjects [15],

[16]. The implementation of PBL also aligns with the Indonesian government's Merdeka Belajar initiative, which promotes student autonomy and active learning [17]. Despite these benefits, PBL alone may not fully address the needs of culturally diverse classrooms, making its integration with CRT a promising alternative.

However, challenges emerge when PBL is implemented in culturally heterogeneous classrooms without adequately aligning with students' experiences. Standard PBL frameworks often overlook cultural dimensions, creating potential disconnects between students and instructional content. This is where the integration of CRT into PBL becomes crucial. While PBL provides an active and collaborative learning structure, CRT ensures that learning content is culturally relevant and meaningful to students. Research suggests that combining CRT and PBL enhances student motivation, engagement, and comprehension more effectively than traditional PBL approaches [18]. A classroom action study applying CRT-based PBL demonstrated significant improvements in students' mathematics learning, increasing learning mastery from 40.63% (pre-cycle) to 71.87% after two cycles [19]. This underscores the potential for integrating CRT and PBL to optimize learning outcomes, although further research remains limited. Furthermore, a structured integration of these two approaches may create a more inclusive and effective learning environment.

Apart from pedagogical approaches, educational technology is also essential in modern learning. Quizizz, an interactive gamification-based assessment platform, enables students to engage with learning material through game-like quizzes, instant feedback, and real-time competition[20]. Integrating Quizizz within PBL learning environments provides a more engaging experience, allowing students to complete contextual problem-based quizzes as part of their learning activities [21], [22]. Furthermore, Quizizz enables teachers to incorporate culturally relevant question content and real-life examples, supporting CRT's goal of making learning more meaningful [23]. The combination of CRT, PBL, and gamified digital tools like Quizizz is expected to enhance learning effectiveness, particularly in classrooms with diverse student backgrounds.

By integrating Culturally Responsive Teaching (CRT), Problem-Based Learning (PBL), and interactive technology (Quizizz), this study aims to develop innovative learning strategies that effectively address the problem of low student learning outcomes while aligning with student characteristics and current educational needs. The CRT-PBL model, supported by Quizizz, has demonstrated effectiveness and can be adopted and adapted across different classrooms. This approach empowers teachers to implement student-centred, culturally responsive, and technology-enhanced instruction, ultimately fostering greater student engagement and academic achievement. Given these potential benefits, this study serves as an important contribution to the field of education by offering a structured pedagogical framework that combines cultural relevance, inquiry-based learning, and digital assessment tools.

Based on the discussion above, this research seeks to answer the question: "To what extent can the application of the Culturally Responsive Teaching (CRT) approach, assisted by Quizizz within the Problem-Based Learning (PBL) model, improve student learning outcomes?" This study aims to provide empirical evidence of the effectiveness of the Quizizz-based CRT-PBL model and offer recommendations for educational practitioners to

enhance the quality of learning in Indonesia. By addressing this research question, the study seeks to contribute to the growing body of literature on culturally responsive pedagogy and its role in improving student achievement in diverse learning environments.

2. METHOD

Classroom action research activities were conducted at SDN Empang 2 Bogor during Semester II of the 2024/2025 academic year. This study followed Suharsimi Arikunto's action research framework, which consists of two iterative cycles [24]. The research involved 28 fourth-grade students from class IV A, selected based on their diverse learning backgrounds, ensuring a representative sample for evaluating the integration of Culturally Responsive Teaching (CRT) and Problem-Based Learning (PBL).

This study employs Stringer's action research model [25], chosen for its iterative and reflective nature, which facilitates continuous assessment and modification of teaching strategies in response to student needs. Stringer's model comprises three key stages: (1) Look, (2) Think, and (3) Act. These stages support systematic inquiry and data-driven decision-making, enhancing instructional effectiveness.

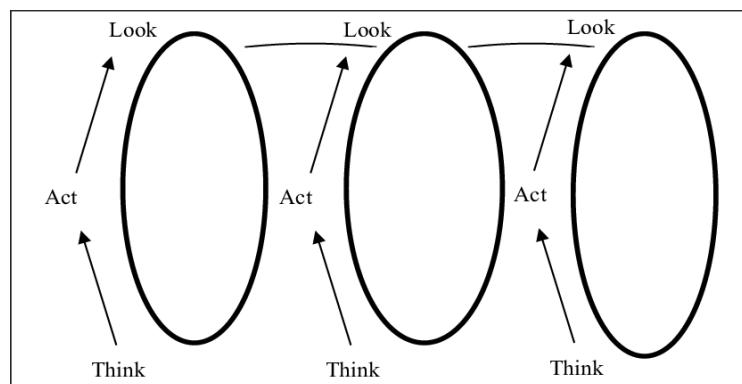


Figure 1. Stringer's Action Research Model

The study was conducted in two cycles, with each cycle encompassing four primary stages: (1) Planning, (2) Implementation, (3) Observation, and (4) Reflection. This structured approach allowed the researchers to monitor progress and refine instructional strategies.

The CRT and PBL models were systematically integrated to enhance student learning outcomes in science education. The CRT framework included five essential components, as seen in Figure 2, namely: (1) Identification of students' culture, (2) Cultural understanding, (3) Collaboration, (4) Critical thinking for reflection, and (5) Transformative construction. Meanwhile, the PBL framework followed a structured five-stage process as seen in Figure 3, namely: (1) Orienting students towards problems, (2) Organizing students to learn, (3) Guiding individual and group investigations, (4) Developing and presenting work results, and (5) Analyzing and evaluating the problem-solving process.

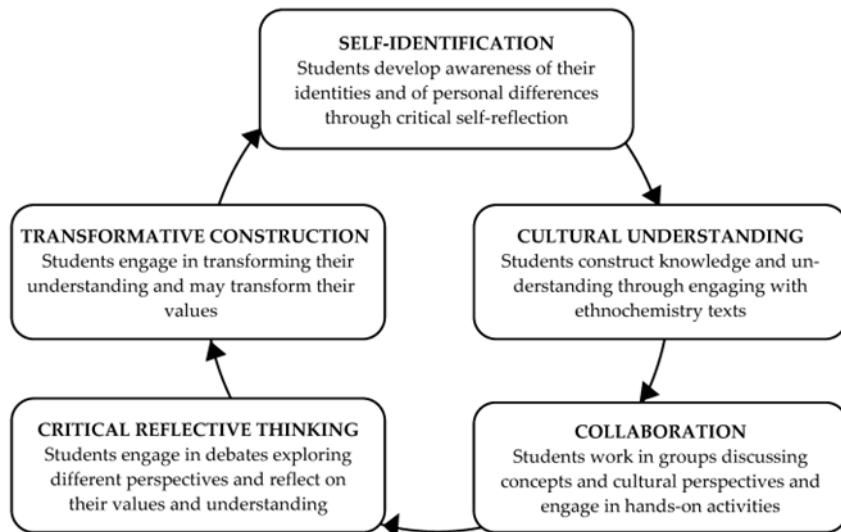


Figure 2. CRT framework

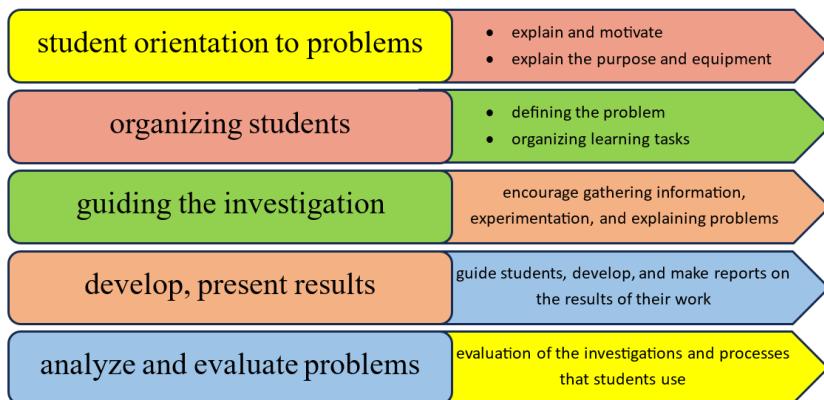


Figure 3. PBL framework

The systematic integration of CRT and PBL aimed to establish a student-centred learning environment that promotes cultural relevance, critical thinking, and problem-solving skills.

3. RESULTS AND DISCUSSION

RESULTS

The research results from the pre-cycle stage to Cycles 1 and 2 indicate a gradual improvement in student learning outcomes, ultimately reaching the expected targets. Each cycle followed four main phases: (1) Planning, (2) Implementing actions, (3) Observing, and (4) Reflection, ensuring a systematic approach to instructional refinement. After analyzing student learning outcomes and engagement in Cycle 1, it was observed that while some students demonstrated progress, others struggled. Key strengths identified in Cycle 1, such as increased student participation and enthusiasm, were maintained, while identified challenges, such as difficulties in understanding culturally embedded content and a lack of active inquiry—served as the basis for modifications in Cycle 2.

Cycle 1, conducted on February 17, 2025, revealed that many students scored below the Minimum Competency Standards (KKTP). Specifically, student engagement was

inconsistent, and some struggled to connect problem-based tasks with their real-life experiences. To address these issues, several modifications were made for Cycle 2, including (a) Strengthening the incorporation of Culturally Responsive Teaching (CRT) elements in formative assessments delivered through Quizizz to enhance cultural relevance, (b) Deepening the integration of students' cultural backgrounds and daily experiences into instructional content to improve contextual understanding, and (c) Fostering more structured active discussions and questioning strategies during the problem orientation phase of Problem-Based Learning (PBL) to promote critical thinking and collaboration.

Cycle 2, implemented on February 25, 2025, followed the same structured phases as Cycle 1. These modifications resulted in significant pedagogical advancements, including (a) A substantial increase in average student scores, with performance exceeding the KKTP benchmark, and (b) Enhanced student engagement, particularly when cultural elements were explicitly embedded within instructional activities and Quizizz-based CRT assessments, making learning experiences more relatable and interactive.

Following the implementation of CRT-PBL with Quizizz, the average student score improved from 67 (Cycle 1) to 80 (Cycle 2), reflecting a 13% increase. Additionally, the proportion of students meeting the minimum competency threshold rose from 46% to 75%, highlighting the effectiveness of the intervention. A detailed statistical analysis was conducted to validate these findings. A paired t-test revealed a statistically significant difference between Cycle 1 and Cycle 2 scores ($t = 4.41$, $p < 0.001$), confirming that the observed improvement was not due to random variation. Furthermore, the effect size (Cohen's $d = 1.18$) suggested a strong and substantial impact of the CRT-PBL model, supported by Quizizz, on student learning outcomes.

Future improvements should optimize time management during the problem orientation phase of PBL to ensure sufficient emphasis on core instructional activities in syntax stages 3–5. The following is a comparison of student learning outcomes between cycle I and cycle II:

Table 1. Comparison of Learning Results for Cycle 1 and Cycle 2 Students

Action	Cycle 1	Cycle 2
Number of values	1876	2240
Class maximum score	2800	2800
Class average	67	80
The highest score	100	100
Lowest value	40	60

DISCUSSION

The findings of this study align with existing literature on Culturally Responsive Teaching (CRT) and Problem-Based Learning (PBL), which emphasize the importance of integrating students' cultural backgrounds into learning to enhance engagement and comprehension [4]. Numerous studies have shown that CRT fosters a sense of belonging, strengthens student identity, and increases motivation, while PBL provides structured opportunities for students to develop problem-solving skills and critical thinking through real-world applications. The results of this research further support the effectiveness of CRT-

PBL integration in improving learning outcomes, demonstrating that culturally contextualized problem-solving activities can lead to more meaningful learning experiences. This is evident in the improvement of student performance across learning cycles, as presented in Table 1. The increase in average student scores from 67 in Cycle 1 to 80 in Cycle 2, along with the rise in the minimum score from 40 to 60, suggests that CRT-PBL combined with Quizizz effectively bridges gaps in learning by making instructional content more engaging and relevant.

Integrating Quizizz as a digital assessment tool contributed significantly to student engagement by incorporating gamification elements into the learning process. Studies have shown that game-based formative assessments enhance student motivation, participation, and knowledge retention. In this study, Quizizz played a crucial role in sustaining student enthusiasm by offering immediate feedback, fostering a competitive yet collaborative learning environment, and reinforcing culturally relevant content more interactively. Students showed greater enthusiasm when using Quizizz-based assessments, particularly when the questions were contextualized to their cultural backgrounds. The improvements recorded in Table 1 further validate this claim, as increased engagement and motivation likely contributed to the higher total student scores in Cycle 2 (2240) compared to Cycle 1 (1876). The consistency of the highest score at 100 across both cycles suggests that while top-performing students maintained their proficiency, the intervention primarily benefited students with lower initial performance, as indicated by the upward shift in the lowest score. These findings suggest that gamification strategies complement CRT-PBL integration and enhance students' cognitive and affective engagement.

While the study demonstrates the potential of CRT-PBL integration in enhancing student engagement and learning outcomes, future research should explore its long-term impact across different subjects and grade levels. For instance, investigating whether the CRT-PBL-Quizizz model remains effective in higher-order thinking subjects like mathematics and science could provide deeper insight into its curriculum adaptability. Further investigations using experimental designs with control groups could also provide stronger causal evidence of its effectiveness, reducing potential biases associated with classroom action research methodologies. Additionally, the need for better time management during PBL implementation, particularly in the problem-orientation phase, is highlighted in this study. The observed improvement from Cycle 1 to Cycle 2, despite the same maximum possible score (2800), indicates that optimizing instructional time for critical learning activities can further enhance student performance.

Although the integration of PBL and CRT has shown promise in optimizing learning outcomes, empirical studies on this combined approach remain limited and warrant further exploration. The findings suggest that PBL alone may not be sufficient for diverse classrooms, and including CRT can address this gap by making learning more relatable to students' lived experiences. Specifically, CRT ensures that problem-based tasks reflect students' cultural backgrounds, increasing their sense of ownership and relevance in learning. The positive trends in learning outcomes across cycles suggest that the structured integration of CRT-PBL can serve as an effective instructional model for improving

academic achievement, particularly for students who initially struggle with conventional approaches.

Limitations and Future Research

Despite the positive results, several limitations should be acknowledged. First, this study was conducted within a single school setting, which may limit the generalizability of the findings. To assess its applicability, future research should explore how CRT-PBL integration performs in different school environments, including rural and urban settings. Second, the research relied on classroom action research, which, while iterative, lacks the rigour of experimental studies with randomized control groups. A more robust methodological approach, such as a quasi-experimental design, could further validate the effectiveness of this pedagogical model. Finally, student motivation and engagement were measured primarily through observations and assessments, and future studies could incorporate qualitative interviews and self-reported engagement surveys for a more comprehensive analysis. Combining quantitative and qualitative data would allow a richer exploration of how students perceive and experience CRT-PBL interventions. Moreover, analyzing the specific learning behaviours that contributed to the score increases recorded in Table 1, such as participation in group discussions or engagement with Quizizz activities, could provide deeper insights into which aspects of CRT-PBL integration are most effective.

Future research should consider expanding the scope of CRT-PBL implementation in different demographic and academic contexts, exploring its effects on students with varying learning needs. For example, investigating how this model supports students with different learning styles, including visual, auditory, and kinesthetic learners, could provide valuable insights into its inclusivity. Furthermore, examining how teacher training in CRT influences its effectiveness in PBL settings would provide valuable insights for policymakers and educators aiming to scale up culturally responsive pedagogy. Developing professional development programs focused on integrating CRT, PBL, and educational technology could enhance teacher readiness and ensure sustainable implementation of this approach in diverse classrooms. Additionally, further research could explore whether repeated exposure to CRT-PBL-Quizizz methods over multiple semesters leads to continued improvement in student learning outcomes or if performance gains plateau over time.

4. CONCLUSION

This study underscores the value of integrating culturally responsive pedagogy with problem-based learning and gamification tools like Quizizz. This study demonstrates that CRT-PBL can effectively enhance student engagement and academic performance in diverse classroom settings by aligning instructional strategies with students' cultural backgrounds and incorporating problem-solving approaches. The findings suggest that CRT-PBL fosters a more inclusive learning environment and is a scalable instructional model that can be adapted to different educational contexts. From an educational perspective, the study highlights the importance of empowering teachers to design culturally responsive and interactive learning environments. Teachers play a central role in ensuring that instructional content remains relevant and meaningful to students, emphasizing the need for ongoing

professional development. Schools and educational policymakers should consider supporting professional development programs that equip teachers with strategies for incorporating CRT and PBL into their pedagogy. This would ensure that culturally responsive and inquiry-based learning becomes a fundamental component of classroom instruction.

While this research demonstrates the effectiveness of CRT-PBL integration, its applicability across different subjects, grade levels, and educational settings requires further examination. The extent to which this approach influences students' long-term knowledge retention and critical thinking skills remains an important area for future investigation. Future research should investigate its long-term effects on student learning retention and explore experimental designs with control groups to provide stronger causal evidence. Additionally, examining how CRT-PBL impacts different types of learners—such as students with diverse cognitive abilities, socioeconomic backgrounds, or language proficiencies—could provide a more nuanced understanding of its effectiveness.

One limitation of this study is its focus on a single school setting, which may limit the generalizability of the findings. Expanding the scope of research to multiple schools, including rural and urban institutions, would help determine whether CRT-PBL maintains its effectiveness across various demographic and institutional contexts. Future research should examine how CRT-PBL performs across various educational contexts and student demographics to ensure its scalability and effectiveness on a broader scale. Moreover, further exploring how technology, such as adaptive learning platforms or artificial intelligence-driven assessments, can complement CRT-PBL may offer new opportunities for enhancing student-centred learning.

Ultimately, this research contributes to the broader discourse on culturally responsive pedagogy, emphasizing its potential to enhance student engagement, motivation, and academic achievement in diverse classroom settings. As education evolves in response to globalization and technological advancements, integrating culturally responsive and technology-supported pedagogical models will be critical to fostering more equitable and effective learning experiences.

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